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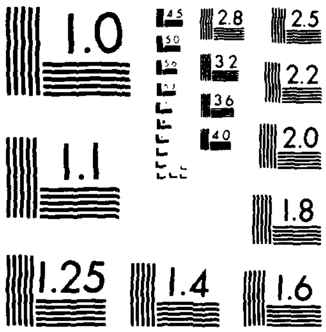

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ANNUAL REPORT
1984

AF LOGISTICS COMMAND

DIRECTORATE
OF
MANAGEMENT SCIENCES

FOREWORD

The Directorate of Management Sciences, (XRS) conducts and sponsors studies and research of significant logistics issues.

In 1984 we concentrated on assisting the rest of the staff with analyses that relate logistics resource alternatives to the peacetime readiness and wartime sustainability of AFLC's customers--the operating commands. That focus will continue in 1985 and beyond.

In this first Annual Report ~~we~~ will discuss the capabilities of the XRS organization, its goals for the future, some specific accomplishments in 1984, and our program for 1985.

We encourage you to contact us regarding our past, current, and future efforts. If you have a problem, maybe we can help.

VICTOR J. PRESUTTI, JR.
Director, Management Sciences
DCS/Plans and Programs

CHARLES C. McDONALD
Major General, USAF
DCS/Plans and Programs

EXECUTIVE SUMMARY

The Directorate of Management Sciences (AFLC/XRS) conducts and sponsors studies and research of significant logistics issues. We use, modify, and develop new or improved methods, models, and tools to manage logistics resources. We have developed outstanding capabilities in determining requirements for recoverable items (items that are repaired, as opposed to thrown away, when they fail), relating recoverable item assets to the number of aircraft available to accomplish the mission, and relating jet engine maintenance shop resources to aircraft availability.

Our focus is on relating logistics resource alternatives to the peacetime readiness and wartime sustainability of the operating commands. In our scenario, the maintenance, distribution, and procurement systems exist only to provide serviceable Line Replaceable Units (LRUs) to keep end items available. The amount of money we invest in the maintenance system, and how we choose to invest it, affects the Base Repair Cycle Time, Depot Repair Cycle Time, and the fraction of repairs that can be accomplished at base level. The amount of money invested in the distribution system, and how it is invested, affects the time it takes to get a serviceable asset from the repair depot to the base and the time it takes to get a reparable carcass from the base to the repair depot. The amount of money invested in the procurement system, and how it is invested, affects the mean time between demands, how often an item must be thrown away, the unit cost, and the procurement lead time.

We have made a great deal of progress in relating LRU dollars to aircraft availability. We have made some progress in understanding the relationship among maintenance system resources, the number of demands on maintenance, and maintenance times. We are beginning work that will help us understand the relationship among distribution system resources, the number of demands on distribution, and distribution times. The Department of Defense is involved in a number of activities that should help us understand the relationship among procurement system resources, the procurement workload and procurement factors. Once we understand these relationships we will know the results that can be expected from expenditures in each of the four resource areas. Then we can begin to trade among LRUs, maintenance system resources, distribution system resources, and procurement system resources to obtain the most force readiness and sustainability for our logistics dollars.

Section III of this report contains some specific results obtained in 1984 that are helping us relate logistics resource alternatives to readiness and sustainability. Section IV has a brief description of each of our major projects for 1985.

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I. THE DIRECTORATE OF MANAGEMENT SCIENCES

The Directorate of Management Sciences (AFLC/XRS) conducts and sponsors studies and research of significant logistics issues. We use, modify, and develop new or improved methods, models, and tools to manage logistics resources. We keep current on logistics research, developments, and studies both internal and external to the Command. Because of our analytical and technical expertise, we act as technical consultants for other AFLC organizations.

We have twenty military and civilian operations research analysts. Three-fourths of these analysts have advanced academic degrees in technical areas (e.g., management sciences, mathematics, engineering). Each new XRS analyst is expected to have, or obtain within his/her training period (normally three or four years), an advanced degree. Our analysts work with both analytical and Monte Carlo simulation computer models. We have developed outstanding capabilities in determining requirements for recoverable items (items that are repaired, as opposed to thrown away, when they fail), relating recoverable item assets to the number of aircraft available to accomplish the mission, and relating jet engine maintenance shop resources to aircraft availability.

The Directorate works closely, and shares results, with other governmental and private analysis organizations such as the Air Force Institute of Technology, the Air Force Academy, the AF Office of Scientific Research, the AF Business Research Management Center, the AF Logistics Management Center, the AF Coordinating Office of Logistics Research, the Human Resources Laboratory, the Rand Corporation, and the Logistics Management Institute.

We don't usually work directly with the AFLC Senior Staff. We've found we are most effective when we work very closely with a study sponsor's action officer and let the action officer interact with the Staff.

II. OUR FOCUS

A. The Goal.

Our five year goal is to be able to put some numbers on the curve you see at Figure 1.

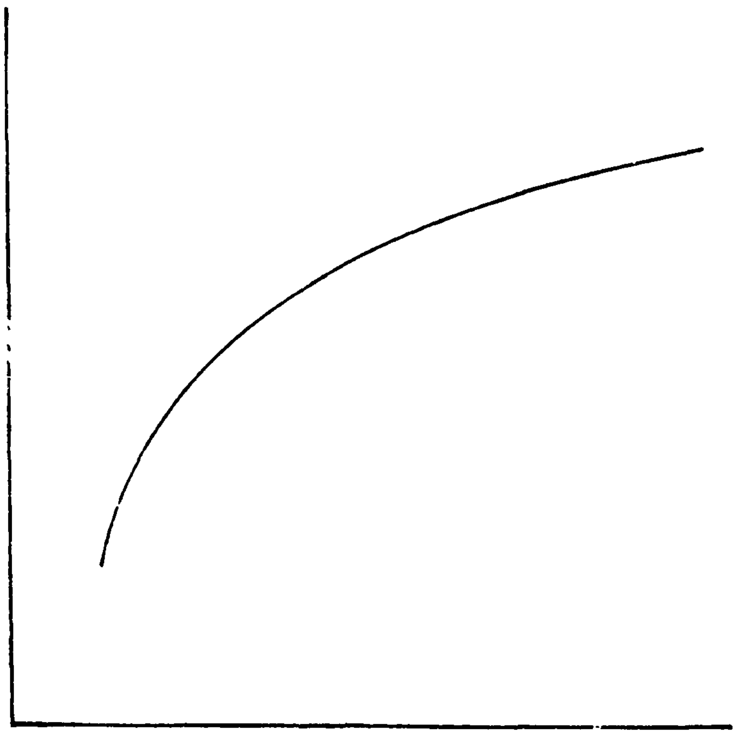


FIGURE 1

Before describing how we intend to accomplish our goal we need to say a few words about our view of the logistics world. Our focus is on AFLC's job of making sure we have enough end items "ready" and "sustainable" to meet the threat. By end items we mean aircraft, spacecraft, missiles, simulators, and other equipment (e.g., telecommunications equipment, vehicles). To make sure we have enough end items available we use the following logistics resources: Line Replaceable Units (LRUs), the maintenance system, the distribution system, and the procurement system.

An LRU is an item that can be removed and replaced directly from an end item. A Shop Replaceable Unit (SRU) is an item removed from an LRU, in a maintenance shop, during the repair of that LRU. For example, aircraft engines are LRUs and engine modules are usually SRUs. SRUs, maintenance equipment, maintenance facilities, maintenance labor, and a maintenance management system make up the maintenance system. Notice that we have included SRUs in the maintenance system. This approach is not as strange as it appears. SRUs are needed only to accomplish maintenance on LRUs. This approach is also consistent with the position that there are really only two kinds of maintenance--"on equipment" (LRUs) and "off equipment" (SRUs). When we use the term "maintenance" we mean off equipment maintenance. The distribution system consists of distribution equipment, distribution facilities, distribution labor and a distribution management system. The procurement system consists of equipment, facilities, personnel, and a management system. We are talking here about systems and not organizations. The maintenance, distribution, and procurement systems cut across organizational lines, with AFLC's Materiel Management organization having a big hand in all of them.

[illegible] the maintenance, distribution, and procurement systems exist only to provide serviceable LRUs when and where needed to keep end items available. The amount of money we invest in the maintenance system, and how we choose to invest it, affects the Base Repair Cycle Time (BRCT), Depot Repair Cycle Time (DRCT), and the fraction of repairs that can be accomplished at base level (R). The amount of money invested in the distribution system, and how it is invested, affects the time it takes to get a serviceable asset from the repair depot to the base (O&ST) and the time it takes to get a reparable carcass from the base to the repair depot (RET). The amount of money invested in the procurement system, and how it is invested, affects the mean time between demands (MTBD), how often an item must be thrown away (W), the unit cost (C), and the procurement lead time (PLT).

The number of spare LRUs needed depends on the resupply time and the demand rate. The user's resupply time is affected by R, BRCT, O&ST, DRCT, W, [illegible] and RET. His demand rate is determined by the MTBD. Because there will never be enough money to have all the aircraft available, the cost of the item, C, is an important factor in obtaining the [illegible] and sustainability for our money. This relationship between [illegible] and the maintenance, distribution, and procurement systems [illegible] illustrated at Figure 2.

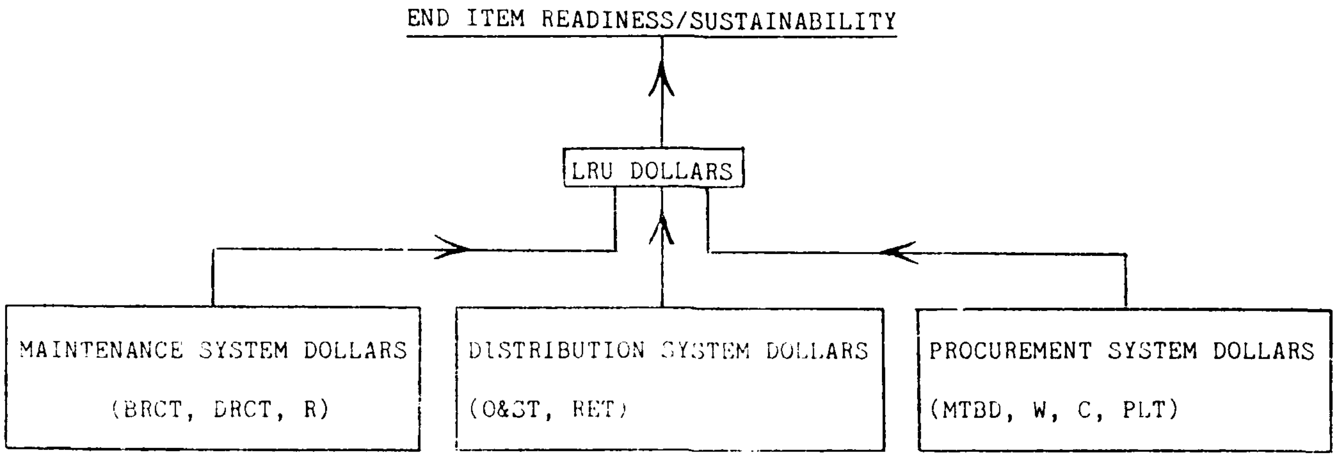


FIGURE 2

In order to accomplish our goal, we first need to understand and model the interactions within each of the four resource areas. For example, how does money spent on depot maintenance manpower affect the DRCT? Then we can begin to trade among LRUs, maintenance system resources, distribution system resources, and procurement system resources to obtain the most force readiness (peacetime) and sustainability (wartime) for our logistics dollar.

B. Line Replaceable Unit (LPUs).

As mentioned earlier, the first step in accomplishing our goal is an examination of each of the resource areas. We have made by far the most progress in relating LRU dollars to aircraft availability. An Aircraft Availability Model (AAM) is about to be implemented in AFLC that allows us to set specific peacetime aircraft availability goals and determine the most economical way, in terms of dollars spent on recoverable items (both LRUs and SRUs), to obtain these goals. This means that we can quantify the relationship at Figure 3 for peacetime operating stock (POS) LRU dollars. AFLC is also in the process of implementing a Weapon System Management Information System (WSMIS) that will enable us to determine the daily availability of aircraft to fly wartime sorties, as a function of recoverable item (again LRUs and SRUs) assets. This means that we can quantify the relationship at Figure 3 for pre-positioned War Reserve Materiel (WRM). Directorate personnel have played important roles in the development and implementation of these capabilities.

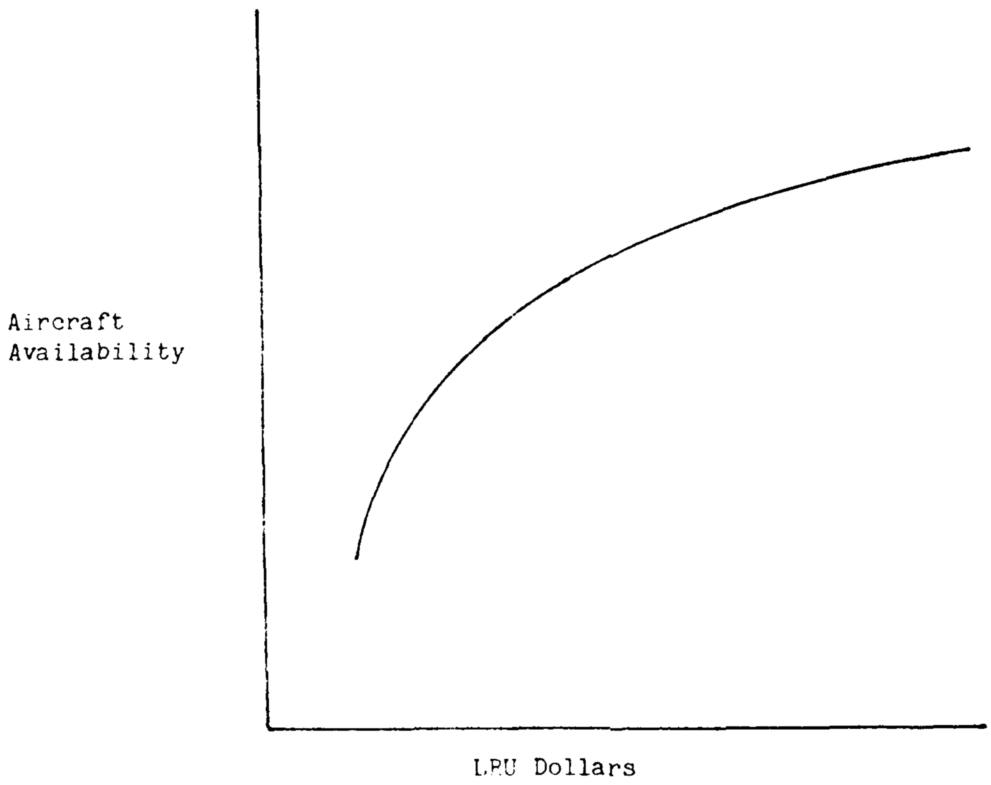


Figure 3.

In the next five years, we plan to enhance our ability to relate investments in LRUs to readiness and sustainability in a number of ways.

Right now aircraft engines are not included in either the AAM or WSMIS. Consequently, both the AAM and WSMIS overestimate the connection between a recoverable item that is an engine component and aircraft availability. Because the engine is "transparent" the item is treated as an aircraft LRU and a shortage of that item "downs" the aircraft. In fact, if we have enough spare engines no aircraft will be down. This problem will be corrected as we help to implement engine information in both the AAM and WSMIS.

Support equipment (e.g., a starter unit) is not included in either the AAM or WSMIS. While this type of equipment is really an end item it might make sense to treat it as an aircraft LRU, a shortage of which will ground the aircraft. Whether support equipment is treated as an end item (in which case we need a number of end items (i.e., the support equipment and the aircraft) available to have an aircraft available), or as an LRU, we will help develop the tools necessary to allow AFLC to incorporate support equipment into both the AAM and WSMIS.

Munitions are not now included in WSMIS. We are currently involved in work which will result in the inclusion of munitions in WSMIS.

Economic Order Quantity (EOQ), or non-recoverable, items are not now included in the AAM or WSMIS in spite of the fact that some of them are LRUs. We are working with some of our colleagues in the private sector to find a way to incorporate EOQ items into the AAM and WSMIS.

There are still some inconsistencies among our initial, replenishment (POS), and wartime requirements computations (e.g., War Readiness Spares Kit (WRSK) requirements are computed assuming a full cannibalization policy while the POS requirement assumes there will be no cannibalization). We will analyze the different requirements and assessment approaches and recommend either a single approach or, as a minimum, compatible approaches.

Recently AFLC awarded a multi-million dollar, multi-year contract for the development of the Requirements Data Bank (RDB). The RDB will be the system AFLC uses to determine the material needed, in peace and war, to support the Air Force's operational commands worldwide. Three XRS analysts are working with our associates in the Materiel Management Deputate to provide the contractors with mathematical techniques for relating engine, recoverable item, EOQ item, test equipment, and support equipment requirements to readiness and sustainability.

We also have recently become interested in Program Objective Memorandum (POM) forecasting techniques for LRUs (actually for all recoverables). This is a very difficult area that has, so far at least, *refused to yield* to micro-model approaches (such as those used in WSMIS and the AAM). We believe we understand the problem with micro-models but we have not yet discovered any other techniques with which we are particularly comfortable. We will continue our search for a technique that can be used to relate expenditures in the POM period to readiness and sustainability.

C. Maintenance.

As stated earlier, by the maintenance system we mean the system that accomplishes off equipment maintenance (i.e., we are excluding flight line maintenance). We need to understand the relationship among maintenance system resources, the number of demands on maintenance and maintenance times (i.e., DRCT & BRCT). That is, for base maintenance shops, and depot maintenance shops (and for consolidated maintenance shops) we need to put some numbers on the curves at Figures 4a and 4b.

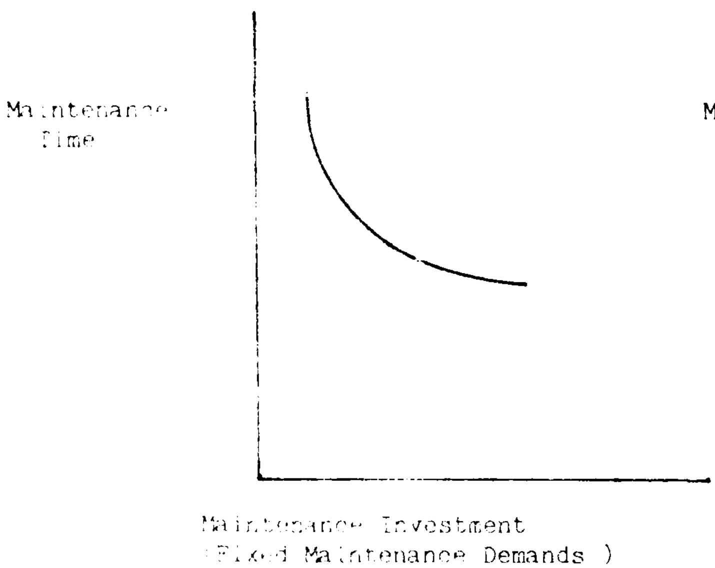


Figure 4a

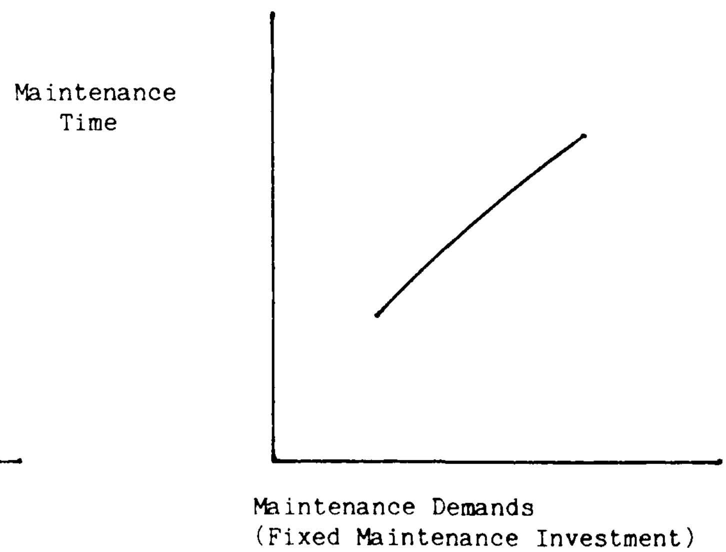


Figure 4b

We have made some progress in this area. In both WSMIS and the AAM the increase in LRU repair times due to SRU shortages is explicitly taken into account. In the AAM we actually choose between buying an SRU and buying an LRU based on this relationship. (Spare LRUs are either ready to install on an aircraft or in "resupply"--maintenance (including

Computational [illegible] surrounding the RDB has also been presented by XRS several times to interested personnel. These personnel include House and Senate Appropriations Committee Staff Members, management personnel associated with the Materiel Management Function, RDB user groups, and members of the Royal Air Force (RAF).

18.5. ANALYSTS: Mrs Priscilla A. Chadwick,
Capt Linda Pangborn,
Mr J. M. Hill; (513) 257-2167; AV: 787-2167

19.1. TITLE: Storage of A-10 Aircraft Battle Damage Repair (ABDR) Spares Kits

19.2. CUSTOMER: AFLC/MAW

19.3. OBJECTIVE: ABDR kits are used to rapidly repair battle damaged aircraft at forward sites. Some kits contain large parts such as wings and nacelles. Due to their large size, many of the A-10 kit parts stored at RAF Bentwater were stored outside and were suffering corrosion damage. We were asked to determine if these ABDR kits could be stored under cover at RAF Kemble without interfering with current operations or future plans.

19.4. RESULTS: We determined that the A-10 ABDR spares kits could be stored at RAF Kemble and would, in fact, contribute to the accomplishment of the RAF Kemble 5 Year Plan and the European Distribution System Forward Storage Plan. These parts are now being stored at RAF Kemble.

19.5. ANALYST: Jim Fleck; (513) 257-6920; AV: 787-6920

20.1. TITLE: Results of Using an Item-by-Item Micro Model for POM Forecasting

20.2. CUSTOMER: AFLC/XR

20.3. OBJECTIVE: To see if we could improve Program Objective Memorandum (POM) forecasts for recoverable items by using item specific [illegible].

20.4. RESULTS: Using data for 30 June 1984 we ran our research model of the recoverable spares requirement computation to compute requirements for the execution of FY84 and FY85, FY86, and FY87. We obtained reasonable answers for the first computation and then requirements dropped off dramatically. That's because the buy we make in any given year reflects all sorts of previously unanticipated problems (e.g., failure rates have increased). Item specific models "fix" all the known problems in the first computation and then assume there will be no new problems. We realized this would cause us to underestimate the FY86 and FY87 requirements. The size of the underestimation was a surprise.

20.5. ANALYST: Major Ron [illegible]; (513) 257-6920; AV: 787-6920

b. [illegible]--Program that relates the number of spare engines required [illegible] support a fleet of aircraft with a user supplied flying program, engine failure rate, and engine repair and resupply times. Program also reports how [illegible] spare engines are expected to be distributed across the repair and [illegible] pipeline segments. Currently exists for the C-5, [illegible], and [illegible] aircraft.

c. [illegible] above, but also considers [illegible] engine requirements. Currently exist [illegible]

d. [illegible] the Engine Meaningful [illegible]. [illegible] project estimates wartime aircraft [illegible] as a function of engine [illegible]

[illegible]

18.1. TITLE. [illegible] RDB [illegible] Project

18.2. CUSTOMER: [illegible]

18.3. OBJECTIVE: The Air Force Logistics Command (AFLC) has recognized [illegible] need for improved [illegible] management systems. This need [illegible] be met through the development and implementation of the RDB. The [illegible] include all [illegible] manual functions in the AFLC Material Requirements [illegible] project, XRS is to provide [illegible] technical [illegible] and development of the RDB [illegible] computations, [illegible] technical evaluations of computational [illegible] contractor, and (3) assistance [illegible] to ensure the attainment of the RDB objectives.

18.4. RESULTS: This [illegible] However, XRS did accomplish several [illegible] the request of the RDB technical team [illegible] describing the RDB computational [illegible] this information to [illegible] participated in the [illegible]. The MFD is a [illegible] objectives and, in a [illegible] objectives will be achieved. [illegible] of the RDB were clarified, [illegible] were more fully [illegible] segment of the work schedule [illegible] to be used in evaluating [illegible] updated MFD was used by the [illegible] proposals for completing [illegible] paper discussing the RDB computational [illegible]. The paper was provided [illegible] helped alleviate some [illegible] be used as an [illegible] the

The study further suggests that the variability about the mean aircraft availability reported in analytic models such as Dyna-METRIC (a model which assesses weapon system capability considering recoverable spares), which also uses the Poisson demand assumption, is also significant.

15.5. ANALYST: Bob Novak; (513) 257-4408; AV: 787-4408

16.1. TITLE: Jet Engine Management Simulator (JEMS) Model Modifications

16.2. CUSTOMER: The Engine Management Community: AFLC/MMMAE, LOC/CFP, ASD/YZL, SA-ALC/MMPRR, OC-ALC/MMPR.

16.3. OBJECTIVE: To modify the JEMS models so that they can more easily be exercised by the using organizations above, with minimal assistance from XRS. JEMS is a family of Monte Carlo simulation models that relate aircraft availability by weapon system to the base level repair and resupply of engines and modules.

16.4. RESULTS: XRS has developed a program which allows users to create and/or modify existing data files for the C-5 model. This computer program speeds up the execution of JEMS models for specific engine applications, and greatly reduces the chances for the errors that previously occurred when changes had to be incorporated into the program. The user interacts with the program through the terminal in a question and answer format. The program allows the entire data file to be created or any selected datum to be edited from an existing file. The format requires less technical knowledge by the user and therefore is less threatening to use. SA-ALC is presently testing the model and providing feedback for potential further improvements.

16.5. ANALYST: Bob Novak; (513) 257-4408; AV: 787-4408

17.1. TITLE: Implementation of XRS Engine Management Software

17.2. CUSTOMER: AFLC/MMMAE, LOC/CFP, SA-ALC/MMPRR, OC-ALC/MMPRR

17.3. OBJECTIVE: To inform other engine logistics support organizations of user friendly software developed by XRSM on the CREATE computer system. The CREATE computer system provides training and [illegible] for most Air Force Logistics Command bases.

17.4. [illegible] above organizations were informed by letter of the [illegible] in their jobs in engine logistics support:

a. [illegible] Documentation program for all JEMS simulation models. [illegible] models, by weapon system, relate aircraft availability to [illegible] repair and resupply of engines and modules. Describes [illegible] current JEMS models. Includes scenarios, [illegible].

14.1. TITLE: [illegible]41 Engine Risk Assessment

14.2. CUSTOMER: AFLC/MMMAE, LOC/CFP, OC-ALC/MMPR, HQ MAC/LGM

14.3. OBJECTIVE: To determine if there are enough TF33P-7 engines in the C-141 program to allow diversion of spares to the E-3 program without excessive risk of inadequate support to the C-141 program.

14.4. RESULTS:

a. Developed a Jet Engine Management Simulator (JEMS) computer simulation model which allowed MMMAE to determine that the C-141 wartime mission would be impaired by a reduction of spare engines. This model relates aircraft availability to the repair and resupply of aircraft engines.

b. Also identified the number of maintenance crews in the Jet Engine Intermediate Maintenance (JEIM) shop as the most limiting factor in the wartime engine logistics support to the aircraft.

c. Currently, MMMAE and HQ MAC are working to correct this problem so that JEIM repair of the TF33P-7 engine will not impair the wartime mission of the C-141.

14.5. ANALYST: Bob Novak; [illegible] 257-4408; AV: 787-4408

15.1. TITLE: Jet Engine Management Simulator (JEMS) Variability

15.2. CUSTOMER: XRS Internal Study

15.3. OBJECTIVE: To determine how much variability in the aircraft availabilities predicted in Monte Carlo simulation models such as JEMS, a model that relates aircraft availability to base level repair and resupply of engines, is introduced by assuming that the number of engine failures can be described by the Poisson distribution.

15.4. RESULTS: Determined that the variability in the aircraft availabilities forecasted [illegible] JEMS model [illegible] influenced greatly by how many model replications are [illegible]. Results indicate that averaging 10-20 model runs produces a [illegible] of uncertainty with the result that is 65-[illegible] percent [illegible] the variance resulting from a single model run.

Improper experimental design [illegible] erroneous conclusions. This study aids XRS in the experimental design of all JEMS model applications by providing guidelines on the number of model replications necessary to achieve a desired bound on the variability of the aircraft availability reported. This can also allow [illegible] efficient use of the computer by not specifying excessive model replications.

12.3. OBJECTIVE: Determine if some additional B-1 engine maintenance actions (caused by a program to improve performance) will cause an increase in the number of engines going to the depot for repair.

12.4. RESULTS: In conjunction with ASD/YZL, we have verified that under current maintenance policy the number of engines being returned to depot for repair will increase by a factor of five. This was done using OMENS, an XRS-developed simulation model that examines different opportunistic maintenance policies at base and depot repair facilities. Future work will be done to determine if some maintenance policy changes can reduce this effect.

12.5. ANALYST: Virginia L. Williamson; (513) 257-6531; AV: 787-6531

13.1. TITLE: Engine Meaningful Measures of Merit Methodology--EM4

13.2. CUSTOMER: AFLC/MMMA, LOC/CFP

13.3. OBJECTIVE: To understand how the D-Day quantities of spare engines on hand at bases and the awaiting parts times occurring in the base engine maintenance shops would impact on operational readiness and sustainability measures for the aircraft during war for given scenarios.

13.4. RESULTS: A simulation exercise-regression analysis procedure was developed and applied for the C-5A and the F-4E. The method produced an equation that was useful for assessing peacetime readiness status, for predicting wartime sustainability, and for developing understanding about how much each variable contributes to wartime sustainability.

Some insights were:

a. On-hand serviceable stock has the greatest impact on weapon system availability at the beginning of war.

b. Delays in base level engine repair have the greatest impact starting at about the 45th day of war.

c. The rate at which engines are sent to the depot for repair becomes the most important variable affecting weapon system availability after about a year into the war.

A program called PREDICT was developed and implemented on AFLC's computers to help the LOC personnel assess daily weapon system availability rates based on the daily awaiting parts times being experienced and on the total spares on hand. PREDICT is a very easy program to use with computer terminals in a question and answer mode. It applies the formulas developed by the EM4 process.

13.5. ANALYSTS: John Madden,
Deborah Bialock,
Phil Persensky; (513) 257-4408; AV: 787-4408

9.5. ANALYST: Capt Thomas L. Brayton; (513) 257-6531; AV: 787-6531

10.1. TITLE: B-52 Weapon System Assessment

10.2. CUSTOMER: LOC/SCAO
SAC/LGM

10.3. OBJECTIVE: Determine the proper way to model B-52 operations for wartime capability assessments.

10.4. RESULTS: Working closely with SAC/LGM, we examined the operational characteristics of the B-52 wartime mission. We concluded that the Dyna-METRIC model, designed for wartime weapon system capability assessments for fighter aircraft, could be used for strategic bomber operations by restructuring the data input to the model. We demonstrated satisfactory results with our procedures, and consequently the incorporation of the B-52 into the Weapon System Management Information System/Sustainability Assessment Module (WSMIS/SAM) was accomplished.

10.5. ANALYST: Virginia L. Williamson; (513) 257-6531; AV: 787-6531

11.1. TITLE: Computing the Initial Buy of Recoverable Spare Parts for the F-16 C/D

11.2. CUSTOMER: AFLC/MMMRS

11.3. OBJECTIVE: To compare two methods which compute the initial quantities of [illegible] parts to buy for the F-16 C/D and recommend the best approach.

11.4. RESULTS: The two methods used to compute the initial buy of recoverable spares for the F-16 were Air Force Logistics Command Regulation 57-27 (AFLCR 57-27) and Mod-METRIC. AFLCR 57-27, Initial Spares Computations, buys the pipeline quantity of each item. The pipeline quantity includes items which are needed to meet demands at the base, the depot and to cover the items being shipped between the depot and base for repair. Mod-METRIC buys the spares which minimize the average number of LRU backorders at the base. A backorder is an unfilled demand for an item. Our study showed Mod-METRIC was the better approach to use for the initial buy of recoverable spare parts. The results of this study are being used to develop new guidance on the use of Mod-METRIC for the initial buy of spare parts.

11.5. ANALYST: Capt Melinda Grant; (513) 257-6531; AV: 787-6531

12.1. TITLE: OMENS Application for the F101 Engine

12.2. CUSTOMER: ASD/[illegible]

7.3. OBJECTIVE: Estimate how much F-16 combat capability improves as recoverable item resupply times from the depot are reduced.

7.4. RESULTS: We used Dyna-METRIC, a model for assessing dynamic wartime weapon system capability resulting from recoverable spares, to determine the impact on aircraft availability for a deployed F-16 squadron under varying assumptions about item shipment times for CONUS resupply. The results of this study were used by DST to help determine the benefits that would be realized if distribution times were reduced.

7.5. ANALYSTS: Barbara J. Wieland,
Priscilla A. Chadwick; (513) 257-6531; AV: 787-6531

8.1. TITLE: WRSK/BLSS Data for WSMIS/SAM

8.2. CUSTOMER: [illegible] SMW and LOC

8.3. OBJECTIVE: Develop an interim solution for providing data necessary to the Weapon System Management Information System/Sustainability Assessment Module (WSMIS/SAM).

8.4. RESULTS: D029 is the AFLC data system used to compute War Readiness Spares Kits (WRSK) and Base Level Self-sufficiency Spares (BLSS) for 30 day logistics support for deployed and in-place bases. A revision to D029 implemented in early 1984 omitted factors critical to proper weapon system assessments by WSMIS/SAM. We reacted to this problem by reconstructing the missing data from another source, the Depot Data Bank (D041A). Based on our work in this area, these factors will be reinstated into the D029 system. Pending reinstatement, we have continued to correct all subsequent submissions of D029 data and provided the corrections to WSMIS/SAM and numerous other users.

8.5. ANALYSTS: Capt Thomas [illegible] [illegible],
Barbara J. Wieland; (513) 257-6531; AV: 787-6531

9.1. TITLE: Modeling Strategic Airlift with Dyna-METRIC

9.2. CUSTOMER: [illegible] AFLC/LMSC/SMW

9.3. OBJECTIVE: [illegible] proper way to model strategic airlift operations [illegible] capability assessments.

9.4. RESULTS: [illegible] with [illegible] MAC, AFLC LOC/AT and DRC (Dynamics Research [illegible]), we examined the operational characteristics of [illegible] mission. We concluded that the newest version of Dyna-METRIC [illegible] originally designed for tactical fighter operations [illegible] used to model strategic airlift by restructuring [illegible]. We demonstrated satisfactory results with our [illegible], and consequently the incorporation of strategic airlift into the [illegible] (Weapon System Management Information System/Sustainability Assessment Module) [illegible] be accomplished.

sufficient for the first 30 days of a war--for these same increases in reliability. In addition we determined the savings in F100 engines (the engine used on the F-15 and F-16) and the direct F100 engine maintenance manpower savings due to increases in reliability. Our results were given to the Commander who used them in a number of speeches to defense contractors.

4.5. ANALYSTS: XRS Staff; (513) 257-6531; AV: 787-6531

5.1. TITLE: The Effect of Aircraft Age on Maintenance Costs

5.2. CUSTOMER: AFLC/XR

5.3. OBJECTIVE: To determine the effect of aircraft age on maintenance costs.

5.4. RESULTS: It had generally been assumed in AFLC that maintenance costs were increasing drastically because the Air Force fleet of aircraft is aging. We learned from available literature and our own detailed examination of maintenance costs that aging is a minor contributor to increased maintenance costs. Instead, the more complex, high performance, and non-conventional aircraft that have entered the inventory in recent years seem to be the major contributors. Our study has helped to change some perceptions of the effect of aircraft age on maintenance costs.

5.5. ANALYST: Hugh D. Hunsaker; (513) 257-6531; AV: 787-6531

6.1. TITLE: Aircraft Availability Enhancements to Mod-METRIC

6.2. CUSTOMERS: AFLC/MMME

6.3. OBJECTIVE: To enhance the Mod-METRIC model, used for computing spare parts requirements, to provide measures of aircraft availability.

6.4. RESULTS: Mod-METRIC computes recoverable spare parts requirements for a series of budgets. We modified Mod-METRIC so that it now provides the expected number of aircraft not mission capable and the expected number of aircraft mission capable at each budget level. It also provides a plot of aircraft not mission capable against all the budget levels. These new measures can be computed under a no, full, or partial cannibalization policy. These enhancements provide the user a better way to relate spare parts requirements to aircraft availability.

6.5. ANALYST: Capt Melinda Grant; (513) 257-6531; AV: 787-6531

7.1. TITLE: How Pipeline Performance Improvement Affects F-16 Wartime Capability

7.2. CUSTOMER: AFLC/DSTT

which duplicates the official, production model and can be used on our research computer (CREATE) to conduct studies.

2.4. RESULTS: Although the official production model is not yet operational, we did accomplish some major milestones in 1984. Our research model is fully tested and operational. Our research model was developed before the official model because we planned to use it in testing the official model. We have also developed a test data base to test the official model. We are now using our research model and test data base for this purpose.

2.5. ANALYST: Major Ron Stokes; (513) 257-6920; AV: 787-6920

3.1. TITLE: Determine Impact on Reparable Spares Requirements of Using Aircraft Availability Techniques

3.2. CUSTOMER: AFLC/MMM

3.3. OBJECTIVE: To provide senior managers in the Air Force Logistics Command with an estimate of the effect on the requirement of changing from buying recoverable spares to meet a fill rate goal to buying these spares to meet selected aircraft availability goals.

3.4. RESULTS: We used a research model to compare the aircraft reparable spares requirement computed with the requirements algorithm using preliminary Air Staff availability goals with the requirement computed with the Variable Safety Level Algorithm using current fill rate goals. The requirements computed using the availability driven requirements algorithm were not significantly higher than those computed by the current method. This study helped to alleviate concern over the cost of implementing this new technique for computing requirements.

3.5. ANALYST: Major Ron Stokes; (513) 257-6920; AV: 787-6920

4.1. TITLE: Costs Associated with Item Failures

4.2. CUSTOMER: AFLC Commander

4.3. OBJECTIVE: To determine how much of the Air Force Budget could be saved if parts never failed and to show the savings in dollars (with no decrease in force readiness or sustainability) under various increases in reliability (e.g., 10 percent, 20 percent, 30 percent).

4.4. RESULTS: Working with a colleague from the Air Force Accounting and Finance Center (AFAFC), we determined that about 20 percent of the Air Force Budget could be eliminated if parts never failed. Of more practical value, we were able to show how many recoverable item dollars could be saved in peacetime (with no decrease in the number of aircraft available) for a number of modest increases in reliability. We also were able to determine the reduction in F-4, F-15 and F-16 War Readiness Spares Kits (WRSK)--a kit designed to make deployed organizations self-

III. 1984 ACCOMPLISHMENTS

A. Introduction.

This part of the Annual Report covers two kinds of Directorate output for 1984. Section III.B. contains some specific results obtained in 1984. Section III.C. describes a potpourri of activities that "come with the territory."

B. Specific Results.

1.1. TITLE: Variable Safety Level (VSL) Computation For Recoverable Items

1.2. CUSTOMER: AFLC/MMM

1.3. OBJECTIVE: The purpose of this study was to investigate the mathematical techniques being used in the algorithm which computes safety levels for recoverable items. The investigation was requested by the Directorate of Materiel Requirements and Financial Management when it became apparent that unreasonably high safety levels were being computed for some recoverable items.

1.4. RESULTS: The investigation was conducted by a task group consisting of representatives from the Directorate of Requirements, Materiel Control, and Identification Systems; the Directorate of Materiel Requirements and Financial Management; and the Directorate of Management Sciences. The task group was able to identify several errors in the mathematical routine. The errors occurred during the process of moving the VSL computation to the Amdahl computer. When AFLC changed computers it also changed program languages (from FORTRAN to COBOL). Some mistakes were made in the conversion from FORTRAN to COBOL. The errors were corrected. As a result, the safety level requirement was reduced by approximately $[illegible]18 million.

1.5. ANALYST: John [illegible] (513) 257-2167; AV: 787-2167

2.1. TITLE: Computing Requirements to Meet Weapon System Availability Goals

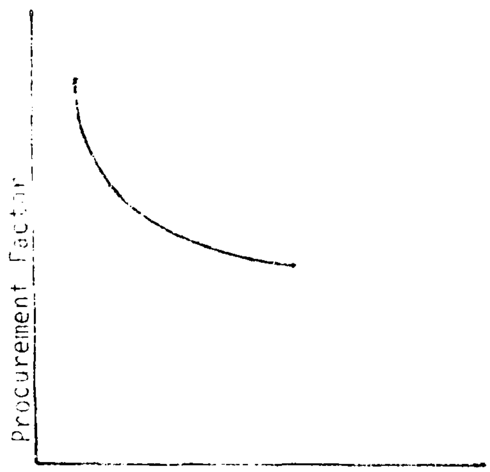
2.2. CUSTOMER: [illegible] Staff, AFLC/MM

2.3. OBJECTIVE: To implement a new procedure for computing the reparable parts (parts which are repaired when they fail instead of merely thrown away) required by the Air Force. This new procedure will compute this requirement in such a way that aircraft availability goals are met while, simultaneously, minimizing the expenditures for these reparable parts. Consequently, we wanted to develop a research model

We are beginning now on a project we call INTEGRATE. This project will prototype an integrated network of computer models or procedures to produce weapon system capability assessments as functions of the major resources. We plan to have it running by the end of 1986. At first, we will feed it bogus input since we won't have all the information needed for Figures 3 through 6b. This will serve two purposes. It will illustrate the mechanism for trading among resource areas. It will also help us get the information necessary to understand the trade-offs within and among resource areas (e.g., if a model run with "soft" information indicates we should spend less money on maintenance and more on distribution, our associates in the Maintenance Deputate will have an incentive to help us get better information).

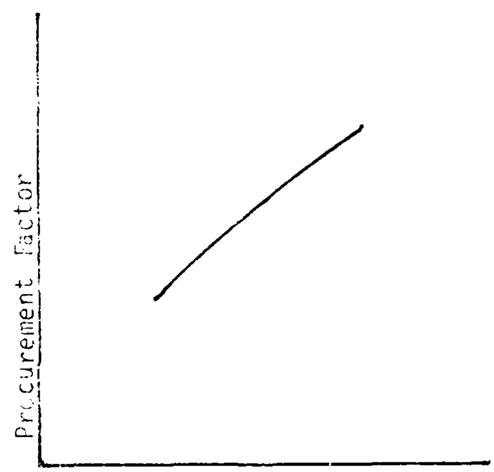
E. Procurement.

We need to understand the relationship among procurement system resources, the procurement workload and "procurement factors" (see Figures 6a and 6b). By procurement factors we mean specifically the demand rate of an item (the reciprocal of the MTBD), how often an item must be thrown away (W), the cost of an item (C), and how long it takes the contractor to deliver an item (PLT).



Procurement Investment
(Fixed Procurement Demands)

Figure 6a



Procurement Demands
(Fixed Procurement Investment)

Figure 6b

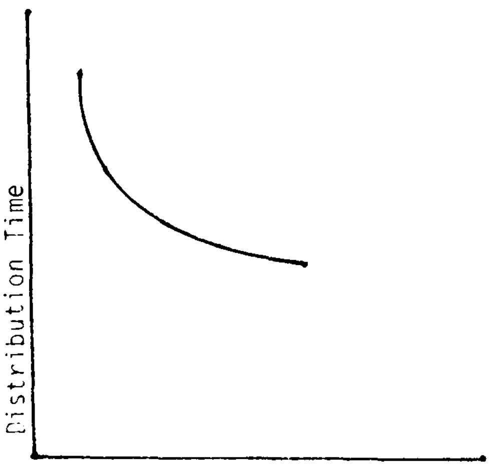
This Directorate has no current plans for in-house work in the procurement area. This area is, however, receiving an unprecedented amount of analysis throughout the Department of Defense. Consequently, we expect that in the next few years we will be able to use the results of this analysis to put some numbers on the curves at Figures 6a and 6b.

F. Putting It All Together.

Once we understand the relationships we have described in the previous sections (II.A. through II.E.) we will know the results that can be expected from expenditures in each of the four resource areas. Then we can begin to trade among LRUs, maintenance system resources, distribution system resources, and procurement system resources (see again Figure 2, page 4) to obtain the most force readiness and sustainability for our logistics dollars. That is, we can draw the curve at Figure 1, page 2, with some confidence.

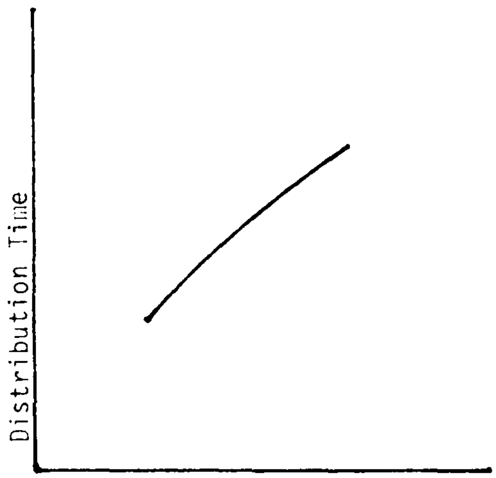
D. Distribution.

We need to understand the relationship among distribution system resources, the number of demands on distribution, and distribution times (e. g., O&ST & RET). That is, for movement of parts among bases and depots we need to put some numbers on the curves at Figures 5a and 5b.



Distribution Investment
(Fixed Distribution Demands)

Figure 5a



Distribution Demands
(Fixed Distribution Investment)

Figure 5b

When we talk about distribution times, we are mostly talking about waiting times. The secret to reducing distribution times is to reduce the time the item spends waiting to be packaged, waiting to be loaded on an aircraft, waiting for whatever.

Up until now, we (XRS personnel) have had virtually no contact with distribution issues. In the future we will be helping our co-workers in the Distribution Deputate with a study that will eventually help us establish the relationships among volume of cargo moved within the United States, delivery times, and distribution system costs.

In the joint Rand/AF "Uncertainty Project" we will be investigating how to make the distribution system more responsive so the maintenance capability within the theater and at the depots can be used to alleviate the swings in repair requirements.

We also plan to investigate how lateral resupply (the shipment of parts--serviceable, or in need of repair--from one user to another user) affects customer resupply times.

awaiting parts) or distribution. In order to increase the likelihood of having an LRU ready for installation, we can buy more LRUs, or buy more SRUs and reduce the number of LRUs awaiting parts.)

We have an XRS developed computer simulation (JEMS) of jet engine intermediate level (base) maintenance shops that can be used to determine the relationship between the resources of the shop (e.g., maintenance personnel, test stands) and maintenance times. This model has been used, for example, by the Military Airlift Command as the basis for a wartime increase in C-5 engine maintenance crews.

In the future we will expand our use of the JEMS model to more aircraft engines. We are also considering building a JEMS-like simulation model of engine maintenance at the depot.

Many EOQ items are used in the repair of SRUs and LRUs. A shortage of these EOQ items increases the repair times of the SRUs and LRUs (in the same way SRU shortages increase LRU repair times). We are, as stated earlier, working with some of our associates in the private sector to find a way to incorporate EOQ items into the AAM and WSMIS.

The lack of test equipment in a maintenance shop also extends item repair times. We plan to enhance WSMIS so that we can quantify the impact of test equipment availability on maintenance times.

We are also working with the Air Staff and the Rand Corporation on something we call the "Uncertainty Project." As part of this project, we are examining the potential contribution of repair to aircraft availability. While intermediate level (base) maintenance is a key part of this effort, a particular emphasis is to understand how best to use depot shops to respond quickly to rapid and unpredictable swings in repair requirements (such as might occur in the initial stages of a wartime surge).

21.1. TITLE: Forecasting Tools

21.2. CUSTOMER: AFLC LOC/TLP

21.3. OBJECTIVE: Examine methods to forecast up to two years into the future several measures of logistics performance for use in periodic Logistics Operations Center (LOC) assessment briefings.

21.4. RESULTS: We developed software to process, examine and display the LOC's data which provided them with a much better understanding of the data used in their presentation of logistics performance measures. We then examined a range of forecasting methods and identified the preferred (Box-Jenkins) forecasting technique. The bottom line of our findings is that analytically sound forecasting techniques require rigorous interaction with skilled analysts. This suggests a careful evaluation of the requirement for the forecasts is necessary, because it will require a serious commitment to acquire the skills to dedicate to the forecasting function.

21.5. ANALYSTS: Virginia L. Williamson,
Priscilla A. Chadwick; (513) 257-6531; AV: 787-6531

22.1. TITLE: Demand Distribution and Variance-to-Mean Ratio of Reparable Items

22.2. CUSTOMER: AFLC/MMMA

22.3. OBJECTIVE: To determine the best way of computing demand variances for reparable items.

22.4. RESULT: The contractor has developed a variance estimating technique. It looks promising and will be tested using historical data.

22.5. ANALYST: Contract study, Mary Oaks; (513) 257-4535; AV: 787-4535

23.1. TITLE: Equipment Requirements and Capability Assessment Methodology

23.2. CUSTOMER: AFLC/MMMA

23.3. OBJECTIVE: Develop a more accurate and timely method of forecasting requirements for equipment items (e.g., avionics test stands).

23.4. RESULT: This contract effort is currently being evaluated by the AFLC/MM staff.

23.5. ANALYST: Contract study, Mary Oaks; (513) 257-4535; AV: 787-4535

24.1. TITLE: Central Procurement Accounting System (CPAS)

24.2. CUSTOMER: AFLC/AC

24.3. OBJECTIVE: CPAS encompasses the automated and manual functions involved in AFLC's Central Procurement Accounting Process. This process provides a means of recording and reporting all financial data relative to procurement using Central Procurement (CP) funds, Foreign Military Sales (FMS) direct citation funds, System Support Division of the Air Force Stock Fund (SSSF), and the Depot Maintenance Service, Air Force Industrial Fund (DMIF) administered by AFLC. Today's systems process approximately three and a half million transactions per year and maintain over 200,000 open contracts that have an Unliquidated Obligation Balance (ULB) of about $16 billion. The financial data involved are in direct support of Air Force weapon systems and have significant impact on the Air Force's ability to carry out its military missions. Currently there are three accounting systems making up the CPAS. They will be combined into a single system. The objective of this effort is to make sure this is accomplished effectively.

24.4. RESULT: This contract effort is currently being evaluated by the AFLC staff.

24.5. ANALYST: Contract study, Mary Oaks; (513) 257-4535; AV: 787-4535

C. Other Directorate Activities

We are the Air Force experts on the Aircraft Availability Model (originally developed by the Logistics Management Institute). This model computes stock levels for recoverable items in order to obtain a pre-specified number of aircraft available at minimum cost. We made some runs using this model for the Rand Corporation; helped Dynamics Research Corporation personnel run the model; and gave numerous briefings on this model to interested parties, including representatives of the Royal Australian Air Force.

We are the Air Force experts on Dyna-METRIC (a Rand developed model that predicts wartime weapon system capability based on the recoverable spares asset position). We have helped Rand correct deficiencies in the model's computer program; developed software support programs for the model; and helped many of our associates understand and use the model.

We have provided technicial guidance regarding the Weapon System Management Information System (WSMIS) to our associates in the Logistics Operations Center (LOC) and the Logistics Management Systems Center (LMSC). Among our activities in this area are providing software changes to correct deficiencies in the Sustainability Assessment Module; demonstrating how to input scenario data to WSMIS; and producing a paper defining some important terms used in WSMIS.

We are the Air Force experts on Mod-METRIC (a requirements computation tool which determines initial recoverable spare part quantities needed to achieve a desired level of base level LRU backorders). We designed

some support software that make Mod-METRIC very user friendly; helped some of our associates use Mod-METRIC to make the initial spares buy for the T-46; made some Mod-METRIC runs for our colleagues at Rand; and lectured on Mod-METRIC to visitors from the Royal Australian Air Force and to Swedish visitors from [illegible].

We are the Air Force technical experts on D028 (an AFLC system that sets base stock levels for recoverable items based on the world-wide requirements computation in the [illegible] system). We helped the Air Force Auditors understand D028. We also investigated the D028 levels of 34 items for the [illegible] Liaison Officer. What we learned in this investigation is causing us to probe deeper into how D028 has been implemented.

We helped design and implement new features in LCOM (a large computer model that simulates the Air Force base level functions of operations, maintenance, and supply) that enhance its capability to deal with sophisticated repair networks and complex maintenance policies. These new features make LCOM a promising candidate for use in modelling some of the more complex aspects of depot level maintenance. We also served as technical consultants to AFLC personnel attempting to use LCOM.

We helped our associates in other organizations develop, find, and use models and computer software routines to facilitate analyses.

We assisted the Air Force Audit Agency with an audit at Ogden of F-16C and D initial requirements for recoverable items.

We provided our comments on the applicability of a number of mathematical models to our associates in other organizations.

We provided comments on a number of technical papers to our associates in other organizations.

We provided the Rand Corporation with data and analyses (e.g., we provided them with information on the F100 engine depot repair process and with an analysis of the effect of improved reliability on aircraft availability).

We presented briefings on [illegible] activities and models to representatives of the Royal Australian Air Force and the United Kingdom Royal Air Force.

One of our senior analysts is an Adjunct Professor at the Air Force Institute of Technology's School of Systems and Logistics (AFIT/SL). We also provide guest speakers every quarter to AFIT/SL courses and helped AFIT develop a course on the Weapon System Management Information System (WSMIS).

We provide a permanent member to the AFLC Logistics Management System Panel. This panel reviews all Program Data Automation Requirements (PARs) and prioritizes them for inclusion in the Major Command Computer Automation Program [illegible].

The XRS Director serves as permanent Chairman of the Management Sciences Study Panel (MSSP). The MSSP makes recommendations regarding AFLC's contract management sciences study program.

An XRS analyst served as a member of a Technical Evaluation Team that helped select a contractor to perform independent audits and evaluations for the AFLC Senior Staff.

A "Summer Faculty Program" Research Associate from North Dakota State University worked with us during the summer of 1984. Based on our recommendations, he is continuing to work on AFLC problems through a grant from the Air Force Office of Scientific Research.

We presented a paper on our Engine Meaningful Measures of Merit Methodology at the 52nd Military Operations Research Society (MORS) Symposium.

IV. [illegible]

A. Introduction.

Section IV.B. is a brief description of each of our major projects for 1985. In most cases, we are already working on these projects.

We have two categories of [illegible] in-house and contract. All the in-house studies are listed before the contract studies. Within each category, the projects are listed by priority. The first project listed is the one we would be the most reluctant to terminate or defer if a new task dictated a modification to our '85 program.

In II. of this report we discussed our current status, and our future plans, regarding our understanding of the relationship between the investment in [illegible] and aircraft availability (II.B.); the relationship among maintenance system [illegible] maintenance demands and maintenance times (II.[illegible]); the relationship among distribution system investment, distribution demands and distribution times (II.D.); the relationship among procurement system investment, procurement demands and procurement factors (II.E.); and finally the relationship among investments in [illegible], maintenance system resources, distribution system resources, procurement system resources and force readiness and sustainability ([illegible]F.). The appropriate section(s) of II. is (are) referenced in parentheses after the title of each project in IV.B. to help you tie the project [illegible] overall goal. For example, if a project helps us relate [illegible] and SRU assets to [illegible] availability the title will be followed [illegible] "([illegible] and [illegible])" since SRUs are maintenance resources [illegible] the time [illegible] spend awaiting parts.

B. [illegible]

[illegible] TITLE: [illegible] Requirements Data Bank (RDB) (II.B. and [illegible])

[illegible] CUSTOMER [illegible]

[illegible] OBJECTIVE: [illegible] computationally feasible mathematical [illegible] requirements computation [illegible] equipment) and across all [illegible] Mathematical techniques [illegible] forecasts.

[illegible] of resources; improved [illegible] in accordance with [illegible]

[illegible] conceptual framework by December [illegible]

[illegible] AN [illegible]

[illegible] 787-2167

2.1. TITLE: Support to Development and Implementation of WSMIS/SAM (II.B. and II.C.)

2.2. CUSTOMER: LMSC/SMW, LOC/TLP-2

2.3. OBJECTIVE: The objective of the project is to continue taking an active role in providing direction to the contractor on technical issues. The functional description laying out the complete sustainability assessment module with all of its enhancements will be thoroughly reviewed. The preprocessor for the SAM effort will be implemented on AFLC/WWMCCS and thoroughly reviewed for technical content and accuracy.

2.4. ANTICIPATED BENEFITS: Ensure technical accuracy of weapon system representation in the system and accuracy of contractor produced software. WSMIS/SAM will relate logistics resources to daily aircraft availability and achievable sorties. CSMS data will feed WSMIS/SAM and weekly production runs will be generated for each weapon system against different war scenarios by base/theater.

2.5. ESTIMATED COMPLETION DATE: Strategic Bomber assessments June 1985. Strategic Airlift assessments September 1985. Dyna-METRIC 4.4 December 1985. Remainder will continue into 1986.

2.6. ANALYSTS: Virginia L. Williamson,
Barbara J. Wieland,
Michael R. Niklas; (513) 257-6531; AV: 787-6531

3.1. TITLE: Incorporate Aircraft Availability Requirement Techniques into D041 (II.B. and II.C.)

3.2. CUSTOMER: AFLC/MM

3.3. OBJECTIVES: (1) Develop, document, program, and test the mathematical algorithms required to incorporate aircraft availability requirement techniques into D041, and (2) provide implementation assistance.

3.4. ANTICIPATED BENEFITS: (1) Provide the capability to compute peacetime aircraft reparable parts requirements to specified aircraft availability goals, and (2) compute a better mix of reparable spare parts in terms of maximizing the gain in aircraft availability per dollar spent.

3.5. ESTIMATED COMPLETION DATE: June 1985

3.6. ANALYSTS: Capt Melinda Grant,
Bill Wysinski,
Major Ron Stokes; (513) 257-6920; AV: 787-6920

4.1. TITLE: POM Assessment Techniques (II.B. and II.C.)

4.2. CUS[illegible] AFLC/XRP

4.3. OBJECTIVE: To review/develop alternative aggregate methods for forecasting the POM budgets by weapon system, and to develop techniques for relating changes [illegible] budgets presented in the Program Objective Memorandum (POM) to [illegible] changes [illegible] (or other appropriate measures) that can [illegible] weapon system.

4.4. ANTICIPATED [illegible]: [illegible] ability to forecast POM budget requirements and to [illegible] these [illegible] to readiness and sustainability.

4.5. ESTIMATED COMPLETION DATE: Review existing aggregate methods by December [illegible]. Remainder will continue into 1986.

4.6. ANALYSTS: John [illegible],
Bob Novak,
Donald [illegible] [illegible]-7408; AV: 787-7408

[illegible] TITLE: [illegible] Management [illegible]ulator (JEMS) (II.B. and II.C.)

[illegible] CUSTOMER: A[illegible]/MMMA, [illegible]; HQMAC/LGSW, ALCs

[illegible] OBJECTIVE: [illegible] Carlo simulation models for each [illegible] aircraft weapon [illegible] relate engine logistics support [illegible] to aircraft capability. To apply these models [illegible] issues. To determine how [illegible] are related to initial D-Day [illegible] waiting parts time, NRTS rates, [illegible]

[illegible] ANTICIPATED [illegible] provide analysts and engine managers with [illegible] determine if the engine support is [illegible] by aircraft weapon system, and will [illegible] and responding to bottlenecks [illegible] (such as number of repair [illegible] stands, etc.). Also, will [illegible] of engine management [illegible] AFLC, the ALCs and the [illegible].

[illegible] friendly models by [illegible].

[illegible]

[illegible]-7408

6.2. CUSTOMER: LMSC/SMW, LOC/TLP-2

6.3. OBJECTIVE: Load the Dyna-METRIC Version 4 capability assessment model on the CREATE computer, test, and make it available to users throughout the Command.

6.4. ANTICIPATED BENEFITS: Supports the WSMIS/SAM combat capability assessment system by allowing consideration of cargo aircraft and depot workload constraints. Since the model is large and complex, we are also producing user interfaces which enable operational level non-programmers to apply Dyna-METRIC. In addition, we anticipate a request for assistance from Requirements Data Bank (RDB) designers. They will be investigating several requirements computation methods, including Dyna-METRIC, and will very likely ask us to help with the evaluation.

6.5. ESTIMATED COMPLETION DATE: December 1985

6.6. ANALYST: Michael R. Niklas; (513) 257-6531; AV: 787-6531

7.1. TITLE: D028 Central Leveling System (II.B. and II.C.)

7.2. CUSTOMER AFLC/MML; ATC

7.3. OBJECTIVE: Include base condemnation rates in D028 to improve compatibility with D041. Also, develop, program, and test mathematical algorithm to maximize aircraft availability for use in D028.

7.4. ANTICIPATED BENEFITS: Better agreement between requirement and distribution computations and improved distribution of reparable stock.

7.5. ESTIMATED COMPLETION DATE: Base condemnation rates in D028 by September 1985. Remainder of project will continue into 1986.

7.6. ANALYST: Capt Melinda Grant; (513) 257-6920; AV: 787-6920

8.1. TITLE: "Uncertainty" (II.B., II.C., and II.D.)

8.2. CUSTOMER: AFLC/XR and USAF/LE

8.3. OBJECTIVE: Work with Rand and the Air Staff to determine how best to counter the major environmental and demand rate uncertainties that surround logistics operations and resource allocation decisions.

8.4. ANTICIPATED BENEFITS: The benefits from this project in the next year are to better define the extent of critical uncertainties that affect logistics support and assess the implications on costs of spares of these uncertainties. In addition, alternatives for dealing with uncertainties will begin to be explored and potential payoffs of responsive repair and distribution will be examined.

8.5. ESTIM[illegible] COMPLETION DATE: Assess the implications on costs of spares [illegible] to uncertainty by December 1985. Remainder will continue into [illegible].

8.6. ANALYST: Curtis [illegible]. Neumann; (513) 257-6531; AV: 787-6531

9.1. TITLE: Incorporate Computation of OWRM Reparable Item Requirements into D[illegible] Using Aircraft Availability Techniques (II.B. and [illegible])

9.[illegible] CUSTOMER: AFLC/MMM

9.[illegible] OBJECTIVES: [illegible] Define the data required for using the Aircraft Availability Model [illegible] compute OWRM reparable item requirements and (2) develop and test Aircraft Availability Model modifications required for the computation of OWRM reparable item requirements.

9.[illegible] ANTICIPATED BENEFITS: (1) The computation of OWRM reparable item requirements in D041 instead of offline will result in using more current/accurate information. (2) Using aircraft availability methodology will result in a more accurate assessment of aircraft availability and a better mix of reparable parts resulting in greater aircraft availability for a given cost.

9.[illegible] ESTIMATED COMPLETION DATE: December 1985

9.6. ANALYST: Bill Wysinski; (513) 257-6920; AV: 787-6920

10.1. TITLE: [illegible]bution (II.D.)

10.2. CUSTOMER: A[illegible]

10.3. OBJECTIVE: The objective of this project is to gain an understanding of the [illegible]ibution process in order to determine what affects the order and [illegible]time, and to determine what actions we can take to affect the movement [illegible] parts. Several aspects of this project are closely related to [illegible] the Uncertainty Project.

10.4. ANTICIPATED BEN[illegible] thorough enough understanding of the distribution [illegible] to begin developing the distribution [illegible] improvement in distribution effectiveness due to design of [illegible] processes and investment in distribution resources.

10.5. ESTIMATED COMPLETION DATE: Complete data collection and analysis assistance on AFLC [illegible] Analysis Study by December 1985. Remainder will continue into [illegible].

10.6. ANALYSTS: [illegible]

[illegible] AV: 787-6531

11.1. TITLE: Munitions Assessment Modeling (II.B.)

11.2. CUSTOMER: LOC/CF, LMSC/SMW

11.3. OBJECTIVE: Investigate alternative methods of munitions assessment modeling, find the necessary data, and determine the best method to incorporate munitions assessments into WSMIS/SAM. Included in this objective is how to best assess preferred versus nonpreferred munitions.

11.4. ANTICIPATED BENEFITS: Inclusion of munitions in the WSMIS/SAM program will help the LOC/CF and appropriate item managers assess preferred versus substitute munitions in terms of mission effectiveness.

11.5. ESTIMATED COMPLETION DATE: December 1985

11.6. ANALYSTS: Virginia L. Williamson,
Michael R. Niklas; (513) 257-6531; AV: 787-6531

12.1. TITLE: Inclusion of Test/Support Equipment in WSMIS/SAM (II.B. and II.C.)

12.2. CUSTOMER: LMSC/SMW, LOC/CF

12.3. OBJECTIVE: The objective of this project is to find the necessary data and determine a means for WSMIS/SAM to provide its users with assessments of how aircraft capability is affected by test/support equipment. We expect that test equipment would be incorporated into the SAM differently than support equipment. In fact, Dyna-METRIC may not even be the best model to use in the case of support equipment. A new tool may have to be added to the SAM.

12.4. ANTICIPATED BENEFITS: The inclusion of test/support equipment in WSMIS/SAM will allow the LOC/CF and the appropriate item managers to better manage test/support equipment by relating the management of these resources to weapon system combat capability.

12.5. ESTIMATED COMPLETION DATE: Complete evaluation of suitability of Dyna-METRIC test equipment feature by December 1985. Remainder will continue into 1986.

12.6. ANALYSTS: Barbara J. Wieland,
Capt Thomas L. Brayton; (513) 257-6531; AV: 787-6531

13.1. TITLE: Integrated Capability Assessment Model (INTEGRATE) (II.F.)

13.2. CUSTOMER: XRS Internal Study

13.3. OBJECTIVE: To develop an integrated set of computer models or procedures to compute weapon system capability assessments as functions of the major resources, such as spares, manpower, facilities, equipment, munitions, etc.

13.4. ANTICIPATED BENEFITS: Provide model to make capability assessments for given resource mixes, help determine more balanced resource allocations, and provide prototype for possible future full scale development and implementation command-wide.

13.5. ESTIMATED COMPLETION DATE: Prototype model(s) by December 1986.

13.6. ANALYSTS: Harold Hixson,
Deborah Blalock,
Phil Persensky; (513) 257-7408; AV: 787-7408

14.1. TITLE: Develop Wartime Assessment and Requirements Simulation (WARS) Research Model (II.B. and II.C.)

14.2. CUSTOMER: Internal Study

14.3. OBJECTIVE: The WARS model computes WRSK/BLSS and OWRM requirements to specified availability objectives. The mathematical algorithms have been programmed and their feasibility verified by a contractor. The objective of this project is to develop the capability within XRS to run and modify the WARS mathematical algorithms.

14.4. ANTICIPATED BENEFITS: Having an in-house capability to run and modify WARS would (1) enable us to verify the accuracy of future production software, (2) give us the capability to make quick turnaround type studies, (3) give us the capability to compare Aircraft Availability Model/Dyna-METRIC/WARS methodologies.

14.5. ESTIMATED COMPLETION DATE: December 1985

14.6. ANALYST: Fred H. Rexroad; (513) 257-6920; AV: 787-6920

15.1. TITLE: Support to LOC Capability Assessment Modeling (II.B. and II.C.)

15.2. CUSTOMER: LOC

15.3. OBJECTIVE: This is an umbrella project that covers overall capability assessment modeling support to the LOC. Major assessment issues that we are working on are covered by other projects. There is some overlap between this project and "Support to the Development and Implementation of WSMIS/SAM."

15.4. ANTICIPATED BENEFITS: The LOC had no capability to use analytical tools for conducting weapon system capability assessments when it was formed. We have introduced techniques to LOC analysts and trained them in their use. During the next year we will continue to provide technical assistance to LOC analysts charged with assessing the impacts of current stockage positions on wartime aircraft availability.

15.5. ESTIMATED COMPLETION DATE: Will continue into 1986.

15.6. ANALYSTS: XRSA Staff; (513) 257-6531; AV: 787-6531

16.1. TITLE: Aircraft Availability Level of Indenture Study (II.B. and II.C.)

16.2. CUSTOMER: XRS Internal Study

16.3. OBJECTIVE: The current version of the Aircraft Availability Model accepts five levels of indenture. This study will look at the difference in results obtained between treating all items as Line Replaceable Units (LRUs) and recognizing the hierarchical nature of the recoverable items.

16.4. ANTICIPATED BENEFITS: Results should indicate the value of recognizing indenture levels in the Aircraft Availability Model. If results show a significant increase in model accuracy then we need to improve the accuracy of our indenture files. If levels add little to model accuracy then computer time could be saved and the model streamlined by considering only one level of indenture.

16.5. ESTIMATED COMPLETION DATE: May 1985

16.6. ANALYST: Bill Wysinski; (513) 257-6920; AV: 787-6920

17.1. TITLE: Incorporate Engine Data into the CREATE Version of the Aircraft Availability Computation (II.B. and II.C.)

17.2. CUSTOMER: AFLC/MMM

17.3. OBJECTIVE: Develop and test the methodology for considering engine indenture, pipeline, and asset information when computing reparable parts requirements in D041. This project will rot address the determination of engine requirements.

17.4. ANTICIPATED BENEFITS: The incorporation of engine information into D041 will enable the algorithm to consider the effects of engine/module indenture, pipeline and asset information. With this information, we will be able to calculate the expected number of engines/modules tied up in repair pipelines and the number awaiting parts and assess their impact on overall aircraft availability. This will result in a more accurate calculation of aircraft availability and also a better mix of reparable parts providing greater aircraft availability for a given cost.

17.5. ESTIMATED COMPLETION DATE: Will continue into 1986.

17.6. ANALYST: Bill Wysinski; (513) 257-6920; AV: 787-6920

18.1. TITLE: Maintenance (II.C.)

18.7. [illegible]

[illegible] OBJECTIVE: [illegible] of this project is to gain a better [illegible] process in order to determine what the major factors are [illegible] maintenance thru-put time and what actions could reasonably be [illegible] this time. In addition, the new [illegible] and Retail System) technology incorporated into [illegible] will be investigated to evaluate the technique's ability to model the [illegible] of depot maintenance workloads on operational [illegible] aspects of this project are closely related to [illegible] project.

18.[illegible] ANTICIPATED BENEFITS: [illegible] thorough enough understanding of [illegible] to begin developing the maintenance [illegible] in maintenance effectiveness [illegible] and investment in maintenance [illegible]

[illegible] ESTIMATED COMPLETION DATE: Analyze existing maintenance process [illegible] continue into 1986.

[illegible] Mark S. [illegible]
Michael [illegible]
[illegible] (513) 257-6531; AV: 787-6531

[illegible] Air [illegible] Inventory Procedures (II.D.)

[illegible]

[illegible] relative to managing and [illegible] efficient methods to achieve [illegible]

[illegible] ANTICIPATED BENEFITS: [illegible] in inventory accuracy.

[illegible] ESTIMATED COMPLETION DATE: [illegible] 1986

[illegible] 257-4535; AV: 787-[illegible]

[illegible]

[illegible]

[illegible] study of the Air [illegible] documents to [illegible] bottlenecks in the [illegible] recommendations for [illegible] acquisition policy.

[illegible] acquisition policy.

15.6. ANALYSTS: XRSA Staff; (513) 257-6531; AV: 787-6531

16.1. TITLE: Aircraft Availability Level of Indenture Study (II.B. and II.C.)

16.2. CUSTOMER: XRS Internal Study

16.3. OBJECTIVE: The current version of the Aircraft Availability Model accepts five levels of indenture. This study will look at the difference in results obtained between treating all items as Line Replaceable Units (LRUs) and recognizing the hierarchical nature of the recoverable items.

16.4. ANTICIPATED BENEFITS: Results should indicate the value of recognizing indenture levels in the Aircraft Availability Model. If results show a significant increase in model accuracy then we need to improve the accuracy of our indenture files. If levels add little to model accuracy then computer time could be saved and the model streamlined by considering only one level of indenture.

16.5. ESTIMATED COMPLETION DATE: May 1985

16.6. ANALYST: Bill Wysinski; (513) 257-6920; AV: 787-6920

17.1. TITLE: Incorporate Engine Data into the CREATE Version of the Aircraft Availability Computation (II.B. and II.C.)

17.2. CUSTOMER: AFLC/MMM

17.3. OBJECTIVE: Develop and test the methodology for considering engine indenture, pipeline, and asset information when computing reparable parts requirements in D041. This project will not address the determination of engine requirements.

17.4. ANTICIPATED BENEFITS: The incorporation of engine information into D041 will enable the algorithm to consider the effects of engine/module indenture, pipeline and asset information. With this information, we will be able to calculate the expected number of engines/modules tied up in repair pipelines and the number awaiting parts and assess this impact on overall aircraft availability. This will result in a more accurate calculation of aircraft availability and also a better mix of reparable parts providing greater aircraft availability for a given cost.

17.5. ESTIMATED COMPLETION DATE: Will continue into 1986.

17.6. ANALYST: Bill Wysinski; (513) 257-6920; AV: 787-6920

18.1. TITLE: Maintenance (II.C.)

18.2. CUSTOMER: Internal Study

18.3. OBJECTIVE: The objective of this project is to gain a better understanding of the maintenance process in order to determine what the major factors are that affect maintenance thru-put time and what actions could reasonably be taken to affect this time. In addition, the new AWARES (Assessment of the Wholesale and Retail System) technology incorporated into Dyna-METRIC Version 4 will be investigated to evaluate the technique's ability to model the effect of depot maintenance workloads on operational capability. Several aspects of this project are closely related to parts of the Uncertainty Project.

18.4. ANTICIPATED BENEFITS: Develop a thorough enough understanding of the maintenance process to allow us to begin developing the maintenance models needed to determine the improvement in maintenance effectiveness due to design of maintenance processes and investment in maintenance resources.

18.5. ESTIMATED COMPLETION DATE: Analyze existing maintenance process models by December 1985. Remainder will continue into 1986.

18.6. ANALYSTS: Hugh D. Hunsaker,
Michael R. Niklas,
Barbara J. Wieland; (513) 257-6531; AV: 787-6531

19.1. TITLE: Air Logistics Center (ALC) Inventory Procedures (II.D.)

19.2. CUSTOMER: AFLC/DS

19.3. OBJECTIVE: Review ALC practices relative to managing and accounting for inventories and determine efficient methods to achieve improvements in inventory accuracy.

19.4. ANTICIPATED BENEFITS: Improvements in inventory accuracy.

19.5. ESTIMATED COMPLETION DATE: April 1985

19.6. ANALYST: Contract study, Mary Oaks; (513) 257-4535; AV: 787-4535

20.1. TITLE: Review AFLC's Acquisition Process (II.E.)

20.2. CUSTOMER: AFLC/PM

20.3. OBJECTIVE: The purpose is to conduct a study of the Air Logistics Centers' (ALCs) processing of acquisition documents to determine the magnitude, location, and nature of bottlenecks in the process, identify inefficient practices, and make recommendations for short term and long term improvements in AFLC's acquisition policy.

20.4. ANTICIPATED BENEFITS: Improvements in AFLC acquisition policy.

15.6. ANALYSTS: XRSA Staff; (513) 257-6531; AV: 787-6531

16.1. TITLE: Aircraft Availability Level of Indenture Study (II.B. and II.C.)

16.2. CUSTOMER: XRS Internal Study

16.3. OBJECTIVE: The current version of the Aircraft Availability Model accepts five levels of indenture. This study will look at the difference in results obtained between treating all items as Line Replaceable Units (LRUs) and recognizing the hierarchical nature of the recoverable items.

16.4. ANTICIPATED BENEFITS: Results should indicate the value of recognizing indenture levels in the Aircraft Availability Model. If results show a significant increase in model accuracy then we need to improve the accuracy of our indenture files. If levels add little to model accuracy then computer time could be saved and the model streamlined by considering only one level of indenture.

16.5. ESTIMATED COMPLETION DATE: May 1985

16.6. ANALYST: Bill Wysinski; (513) 257-6920; AV: 787-6920

17.1. TITLE: Incorporate Engine Data into the CREATE Version of the Aircraft Availability Computation (II.B. and II.C.)

17.2. CUSTOMER: AFLC/MMM

17.3. OBJECTIVE: Develop and test the methodology for considering engine indenture, pipeline, and asset information when computing reparable parts requirements in D041. This project will not address the determination of engine requirements.

17.4. ANTICIPATED BENEFITS: The incorporation of engine information into D041 will enable the algorithm to consider the effects of engine/module indenture, pipeline and asset information. With this information, we will be able to calculate the expected number of engines/modules tied up in repair pipelines and the number awaiting parts and assess this impact on overall aircraft availability. This will result in a more accurate calculation of aircraft availability and also a better mix of reparable parts providing greater aircraft availability for a given cost.

17.5. ESTIMATED COMPLETION DATE: Will continue into 1986.

17.6. ANALYST: Bill Wysinski; (513) 257-6920; AV: 787-6920

18.1. TITLE: Maintenance (II.C.)

18.2. CUSTOMER: Internal Study

18.3. OBJECTIVE: The objective of this project is to gain a better understanding of the maintenance process in order to determine what the major factors are that affect maintenance thru-put time and what actions could reasonably be taken to affect this time. In addition, the new AWARES (Assessment of the Wholesale and Retail System) technology incorporated into Dyna-METRIC Version 4 will be investigated to evaluate the technique's ability to model the effect of depot maintenance workloads on operational capability. Several aspects of this project are closely related to parts of the Uncertainty Project.

18.4. ANTICIPATED BENEFITS: Develop a thorough enough understanding of the maintenance process to allow us to begin developing the maintenance models needed to determine the improvement in maintenance effectiveness due to design of maintenance processes and investment in maintenance resources.

18.5. ESTIMATED COMPLETION DATE: Analyze existing maintenance process models by December 1985. Remainder will continue into 1986.

18.6. ANALYSTS: Hugh D. Hunsaker,
Michael R. Niklas,
Barbara J. Wieland; (513) 257-6531; AV: 787-6531

19.1. TITLE: Air Logistics Center (ALC) Inventory Procedures (II.D.)

19.2. CUSTOMER: AFLC/DS

19.3. OBJECTIVE: Review ALC practices relative to managing and accounting for inventories and determine efficient methods to achieve improvements in inventory accuracy.

19.4. ANTICIPATED BENEFITS: Improvements in inventory accuracy.

19.5. ESTIMATED COMPLETION DATE: April 1985

19.6. ANALYST: Contract study, Mary Oaks; (513) 257-4535; AV: 787-4535

20.1. TITLE: Review AFLC's Acquisition Process (II.E.)

20.2. CUSTOMER: AFLC/PM

20.3. OBJECTIVE: The purpose is to conduct a study of the Air Logistics Centers' (ALCs) processing of acquisition documents to determine the magnitude, location, and nature of bottlenecks in the process, identify inefficient practices, and make recommendations for short term and long term improvements in AFLC's acquisition policy.

20.4. ANTICIPATED BENEFITS: Improvements in AFLC acquisition policy.

20.5. ESTIMATED COMPLETION DATE: July 1985

20.6. ANALYST: Contract study, Mary Oaks; (513) 257-4535; AV: 787-4535

21.1. TITLE: Simplify AFLC Small Purchase Procedures (II.E.)

21.2. CUSTOMER: AFLC/PM

21.3. OBJECTIVE: To obtain recommendations on how to simplify AFLC's Small Purchase Procedure.

21.4. ANTICIPATED BENEFITS: Better Small Purchase Procedures.

21.5. ESTIMATED COMPLETION DATE: May 1985

21.6. ANALYST: Contract study, Mary Oaks; (513) 257-4535; AV: 787-4535

22.1. TITLE: Consumable Item Stockage Policy to Meet a Weapon System Support Objective (II.B. and II.C.)

22.2. CUSTOMER: AFLC/MMMA

22.3. OBJECTIVE: The objective of this study is to help us relate our investment in consumables (items that are thrown away, as opposed to repaired, when they fail), or EOQ items, to weapons system readiness and sustainability.

22.4. ANTICIPATED BENEFITS: Better readiness and sustainability for our investment in EOQ items.

22.5. ESTIMATED COMPLETION DATE: June 1985

22.6. ANALYST: Contract study, Mary Oaks; (513) 257-4535, AV; 787-4535

23.1. TITLE: Technique for Actual Availability Measurement (II.B. and II.C.)

23.2. CUSTOMER: AFLC/XRS

23.3. OBJECTIVE: There are a number of approximate requirements optimization models that relate dollars spent to aircraft availability. All of these models have assumptions that are not consistent with reality. The objective of this study is to develop a tool that will enable us to determine the effect of these assumptions.

23.4. ANTICIPATED BENEFITS: A tool that will allow us to convert theoretical availability to actual availability.

23.5. ESTIMATED COMPLETION DATE: June 1986

23.6. ANALYST: Contract study, Mary Oaks; (513) 257-4535; AV: 787-4535

24.1. TITLE: Development of Software Interface and Interactive Features for ALLOCATE (II.D.)

24.2. CUSTOMER: AFLC/DS and LOC/XOL

24.3. OBJECTIVE: ALLOCATE is an optimization model that will be used on a daily basis to allocate cargo to aircraft in AFLC's LOGAIR (Logistics Aircraft) System. The objective of this study is to develop the software needed to interface the user with the ALLOCATE model and provide the interactive features needed for a complete user-friendly computer based allocation system. It will be used on the Z-100 computer.

24.4. ANTICIPATED BENEFITS: Quicker and better allocation of cargo to aircraft.

24.5. ESTIMATED COMPLETION DATE: March 1986

24.6. ANALYST: Contract study, Mary Oaks; (513) 257-4535; AV: 787-4535

25.1. TITLE: Aircrew Training Devices (Simulators) (II.B. and II.C.)

25.2. CUSTOMER: LOC/TG

25.3. OBJECTIVE: Traditionally, most Aircrew Training Devices (ATDs) have been supported by organic (Air Force) resources at base level and by a mix of organic and contractor resources at depot. The Air Force plans to transition to contractor support of ATDs. The purpose of this effort is to ensure a smooth transition.

25.4. ANTICIPATED BENEFITS: Best possible ATD support.

25.5. ESTIMATED COMPLETION DATE: May 1985

25.6. ANALYST: Contract study, Mary Oaks; (513) 257-4535; AV: 787-4535

V. FINAL REMARKS

In this Report we have tried to describe our capabilities, what we are doing, and why we are doing it.

This is our first Annual Report. We are interested in your suggestions for improving the Report or the study program. Write to AFLC/XRS, WPAFB, Ohio 45433, or call (513) 257-3201 (AV: 787-3201).

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